



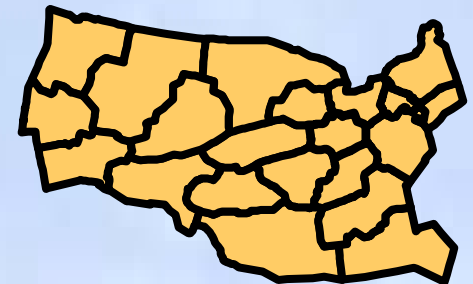
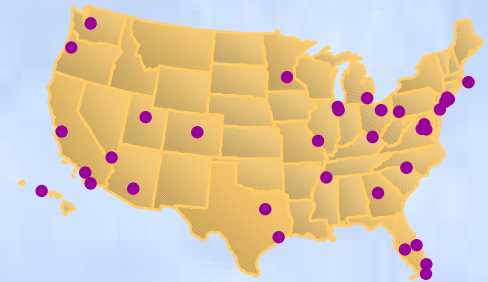
***National Airspace Redesign  
High Altitude Redesign Briefing  
for  
NBAA User Forums***



# National Airspace Redesign

*Primary means of the FAA to modernize US airspace by migrating from constrained ground-based navigation to the freedom of an RNP RNAV satellite-based system*

- Collaborative effort – FAA Management & NATCA
- Bottom up: Optimize & redesign local airspace targeting congested areas ...
  - Focused on key airports and associated airspace; changes in arrival and departure routes drive change up into enroute airspace
- Top down: In parallel, redesign national airspace ... High Altitude Redesign (HAR)
  - By using new technology and airspace concepts, balance flexibility and structure to obtain maximum system efficiency



# High Altitude Redesign

- Influenced by the airspace concepts recommended to FAA by RTCA
  - Frequent meetings with user representatives; advice on:
    - Consistency with original concepts
    - Fleet capabilities and limitations
    - Implementation impacts
- Evolutionary implementation based on emerging technology
  - Plan to begin implementing initial functions in initial airspace during 2003
  - Expansion geographically, vertically and functionally planned through 2008 and beyond
  - With each increment, benefits will increase consistent with user equipage

# RTCA SC192 High Altitude Concept Summary

*“...RTCA SC 192 examined the possibility of defining a high altitude airspace structure where the **FAA could begin to implement many of the Free Flight concepts...***

*The High Altitude Airspace Concept...**could provide more... freedoms...**while offering an opportunity to deploy new technology and procedures in a controlled environment...*

*This airspace would allow **properly equipped users to begin achieving the economic benefits** of flying their preferred routes and altitudes with fewer restrictions...*

*RTCA SC 192 envisions the **initial implementation** of this airspace **at the higher flight levels...**and...at additional levels as technology and procedures allow.”*

# High Altitude Redesign Vision

**Balance flexibility and structure to  
obtain maximum system efficiency**

## Performance Objectives

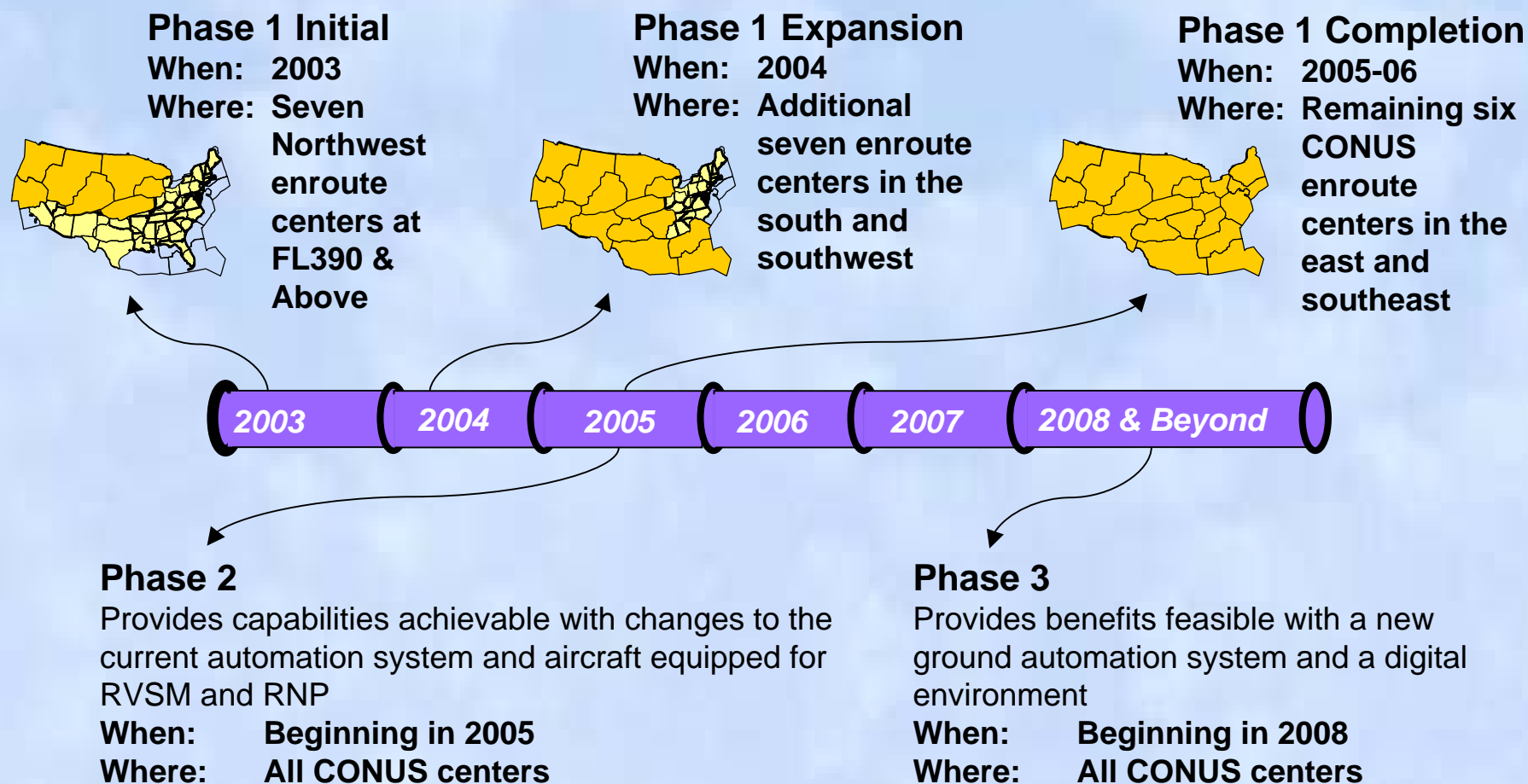
- Improve system efficiency
- Reduce route structure
- Eliminate “airspace” miles-in-trail restrictions
- Increase flexibility for controllers and users

By ...

## Design Objectives

- Point-to-point navigation with pilot navigation in lieu of radar vectors
- Non-restrictive routing wherever efficient
- RNAV/parallel RNAV routes in high density corridors
- Efficient routing around active SUA/ATCAA
- Improved knowledge of SUA/ATCAA status

# Evolutionary HAR Implementation



# Phase 1 Design

## Design Concept:



- RNAV / closely-spaced parallel RNAV routes
  - Using structure where most efficient



- Navigation Reference System
  - Efficiently defining flight paths – tactical and planned



- Non-Restrictive Routing
  - Providing users increased routing flexibility



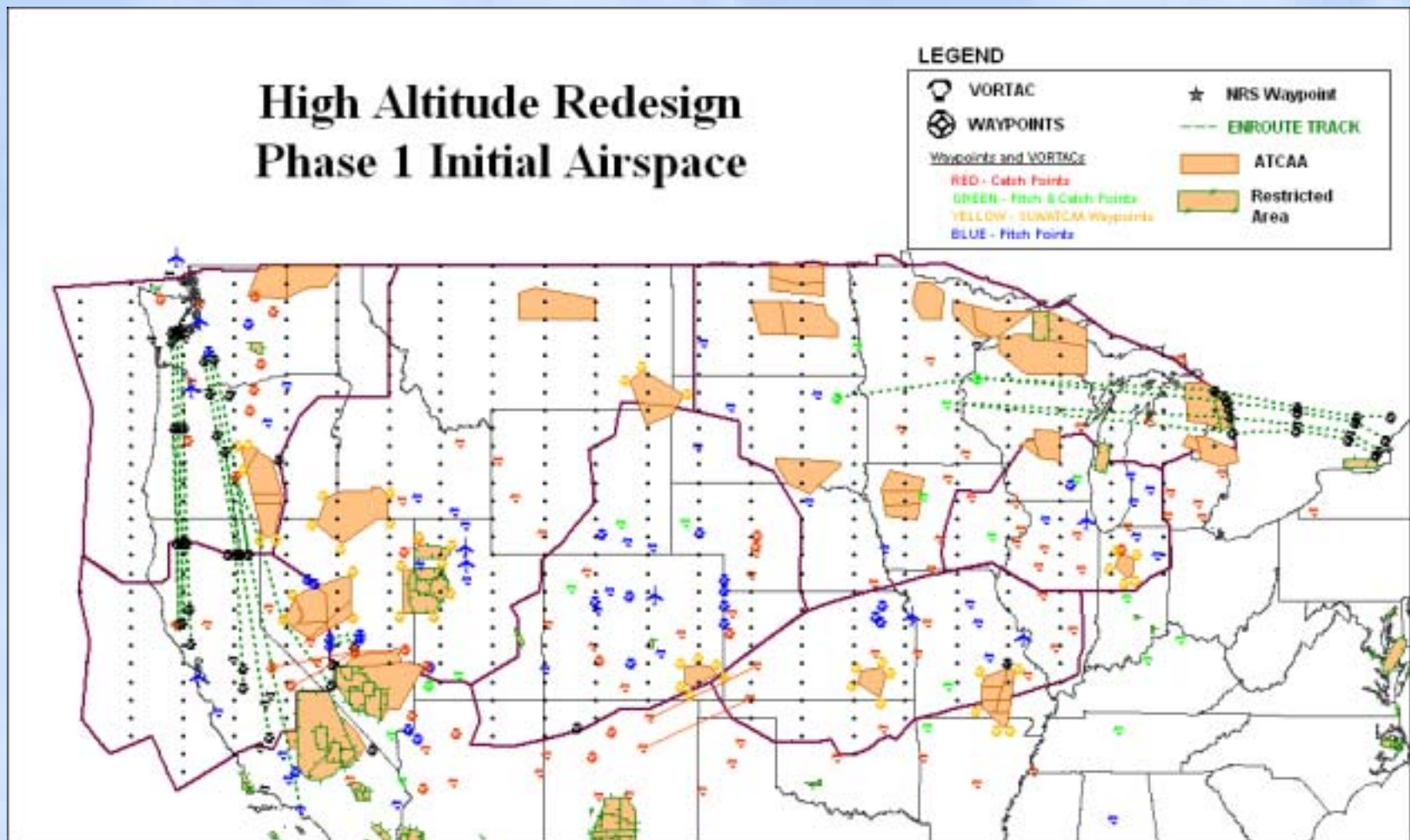
- ATCAA & SUA waypoints
  - Mitigating SUA effects for civilian aviation

## Enabling capability:

- Radar monitoring, RNAV/Advanced RNAV, RNP
- RNAV/Advanced RNAV & FMS data bases capacity
- URET and Navigation Reference System
- RNAV/Advanced RNAV, access to airspace schedules



# Phase 1 Initial Airspace



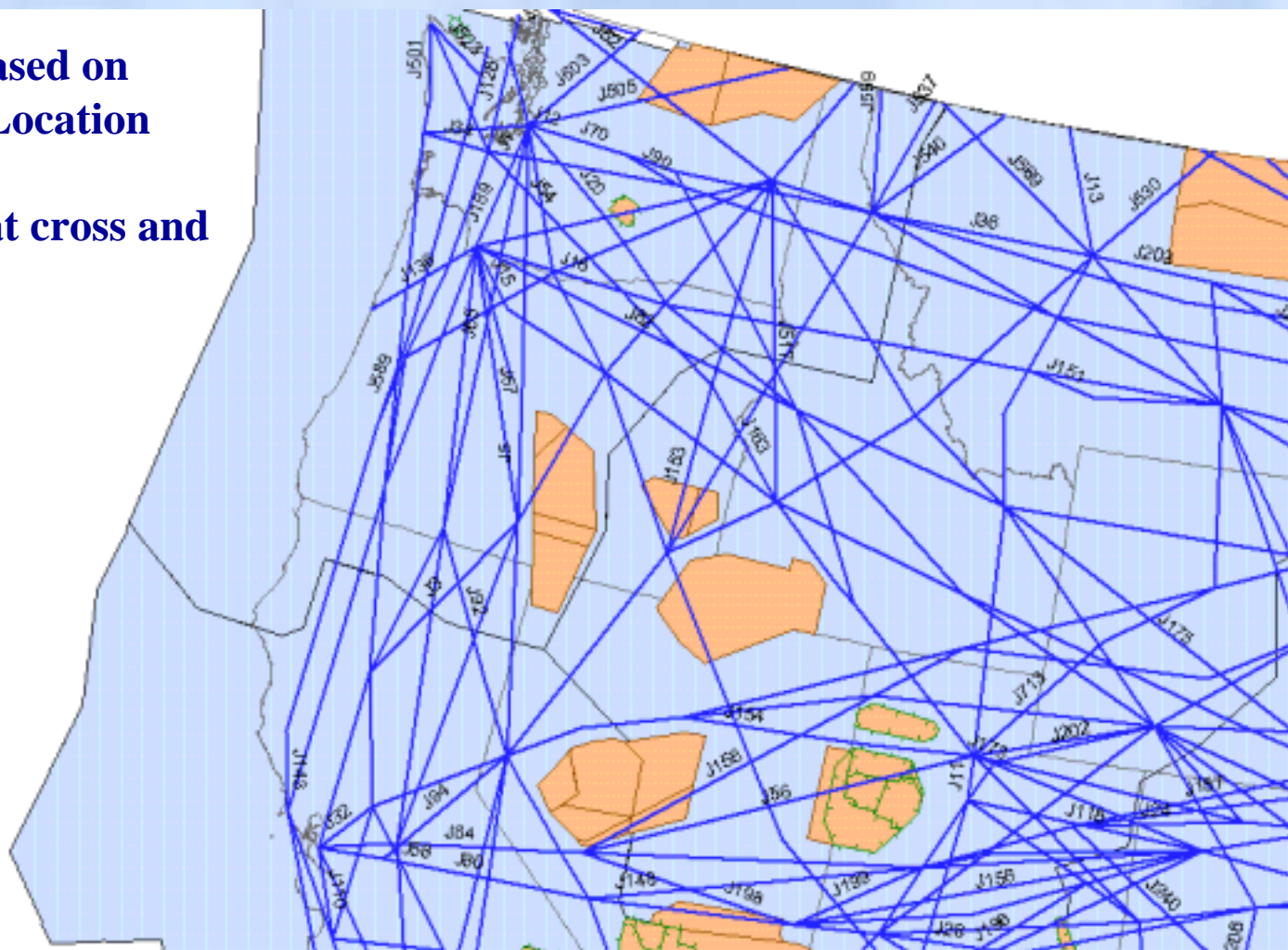


# *ATS “Q” Route?*

- Historically in the U. S., IFR navigation has been through a system of ground-based navigation aids using Federal Airways/Jet Routes that require pilots to fly directly toward, or away from, the NAVAID.
  - This limitation results in less-than-optimal routes, and contributes to the inefficient use of the NAS.
- Area navigation (RNAV) provides users with an ability to fly direct routes between any two points.
- FAA recently adopted International Civil Aviation Organization (ICAO) definition of “Air Traffic Service Route” as a general term to include: Federal Airway, Jet Route and RNAV route
- The US and Canada use "Q" as a designator for RNAV routes (US 1-499/Canada 500-999).

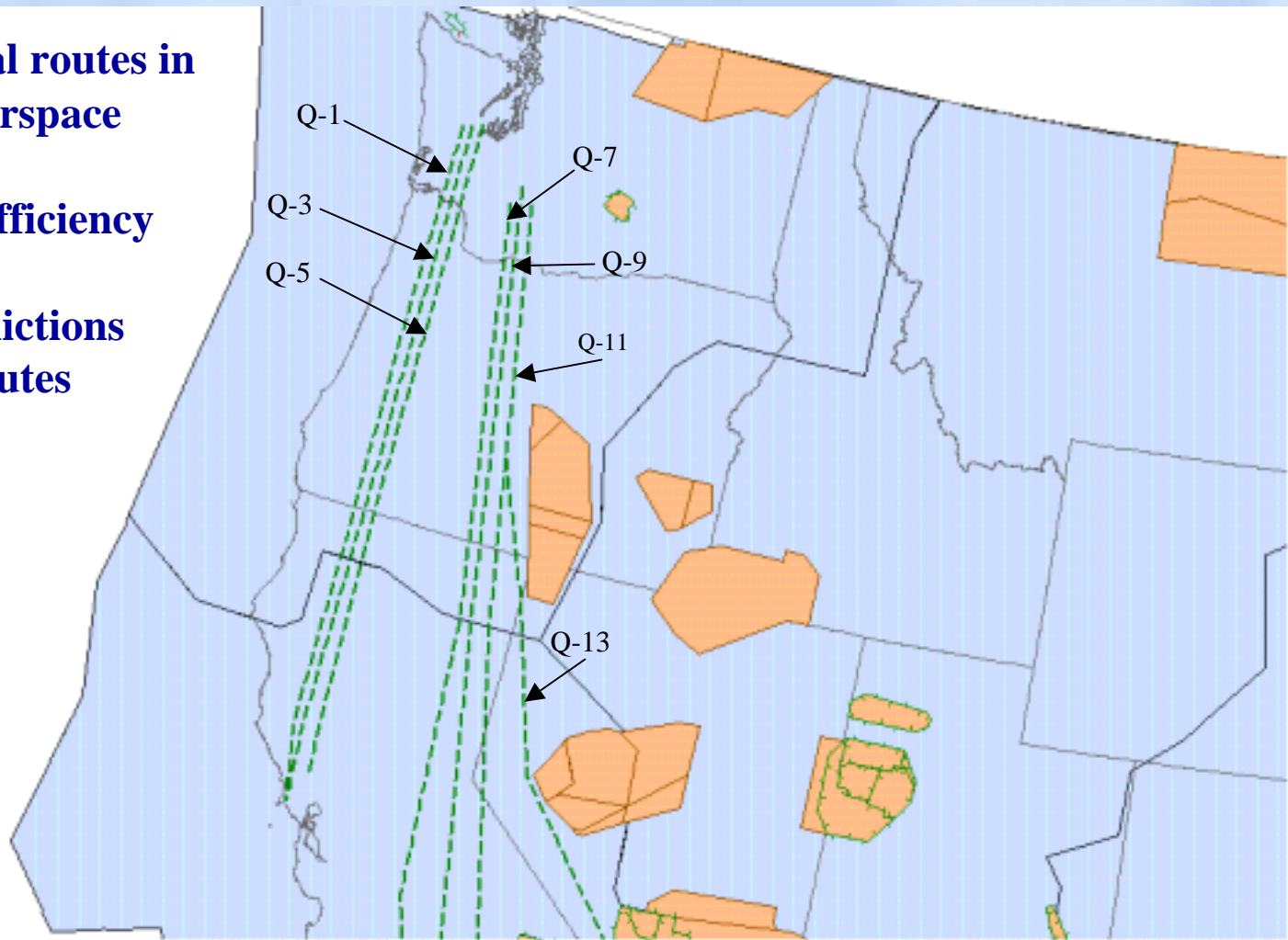
# Jet Routes

- Routes based on NAVAID Location
- Flows that cross and converge



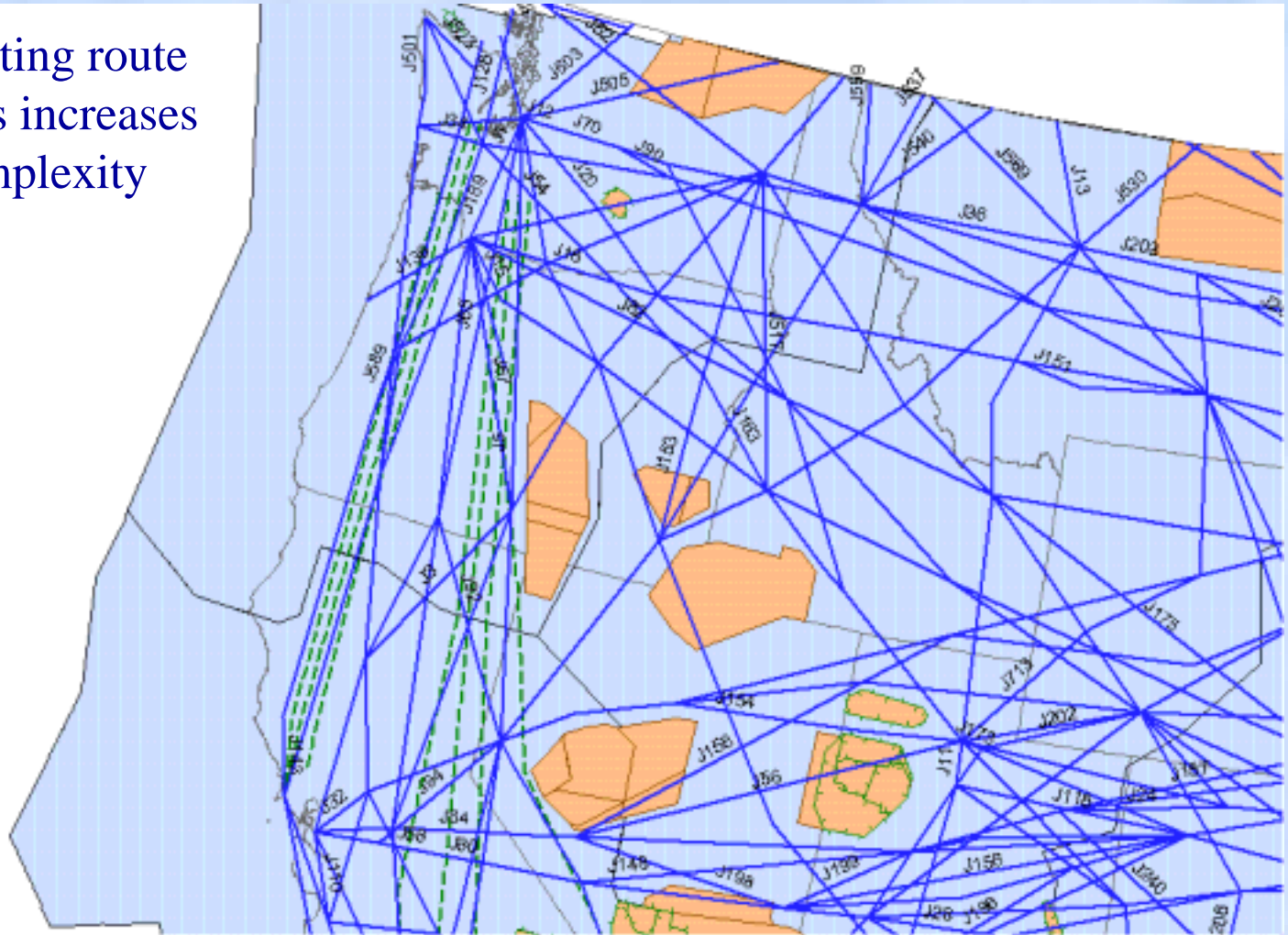
# High Altitude Q Route Examples

- Additional routes in the same airspace
- Greater efficiency
- Less conflicts between routes

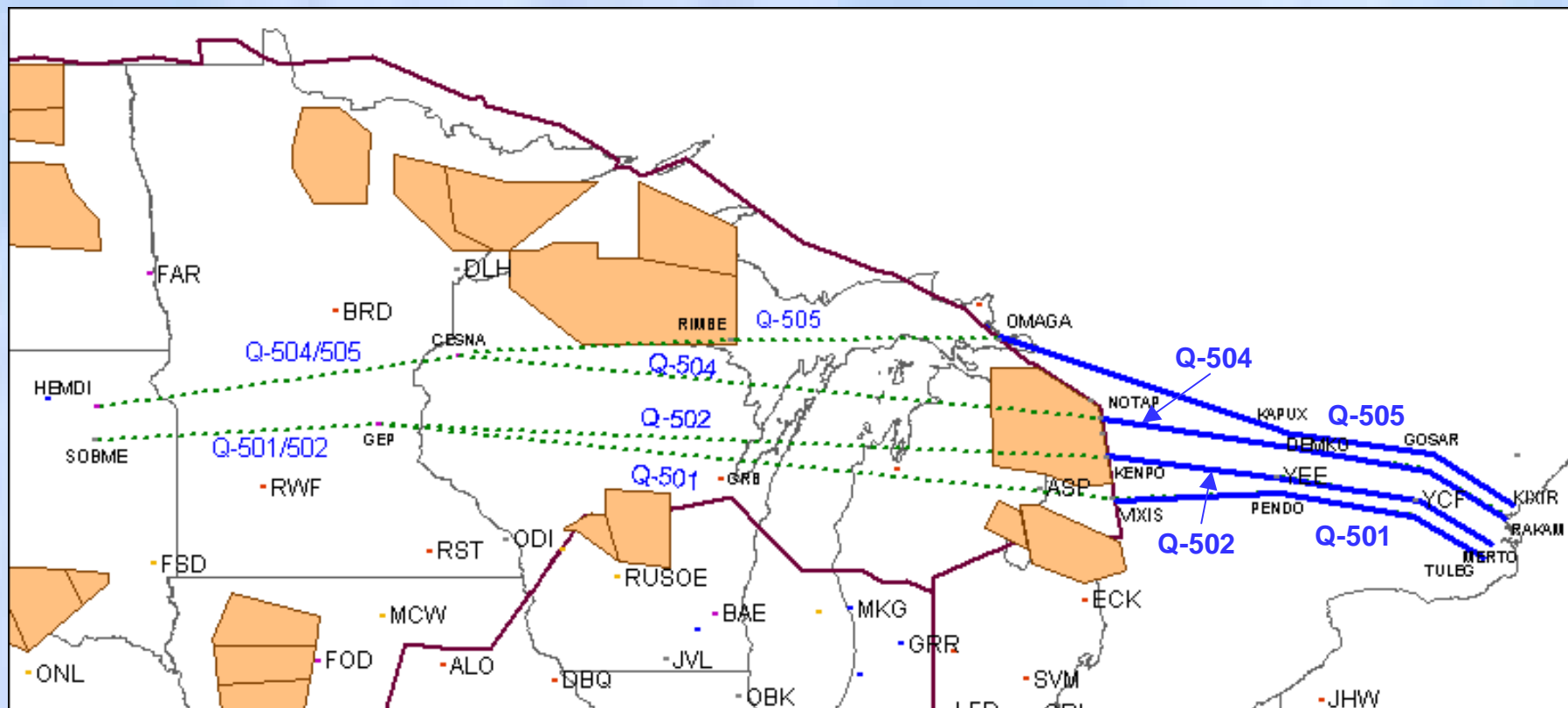


# Q Routes and Jet Route

- Co-existing route structures increases ATC complexity



# Q Routes – US/Canada



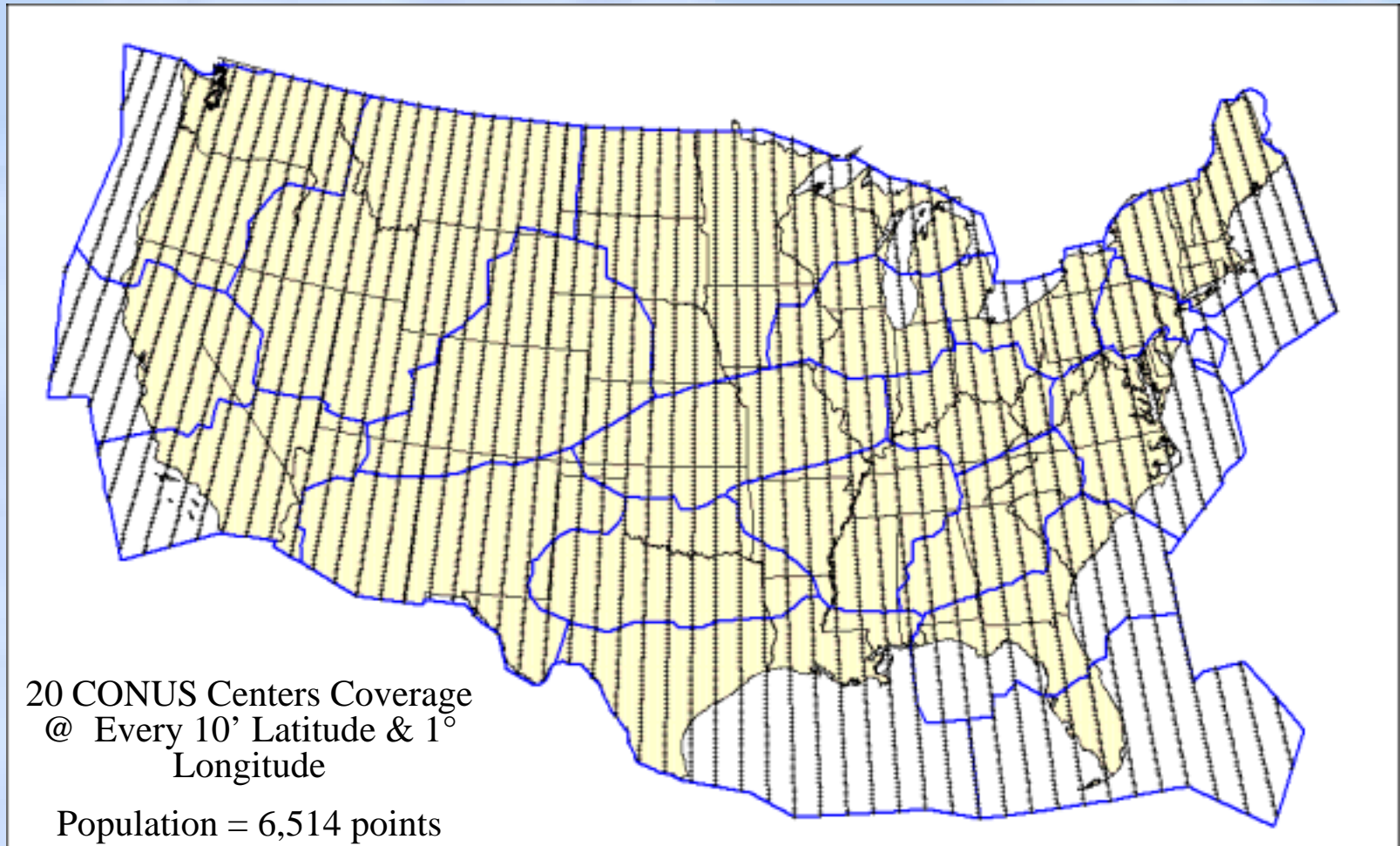
Note: Q Routes in Canada are not charted, but defined as "Fixed RNAV Routes" in Canadian Flight Supplement



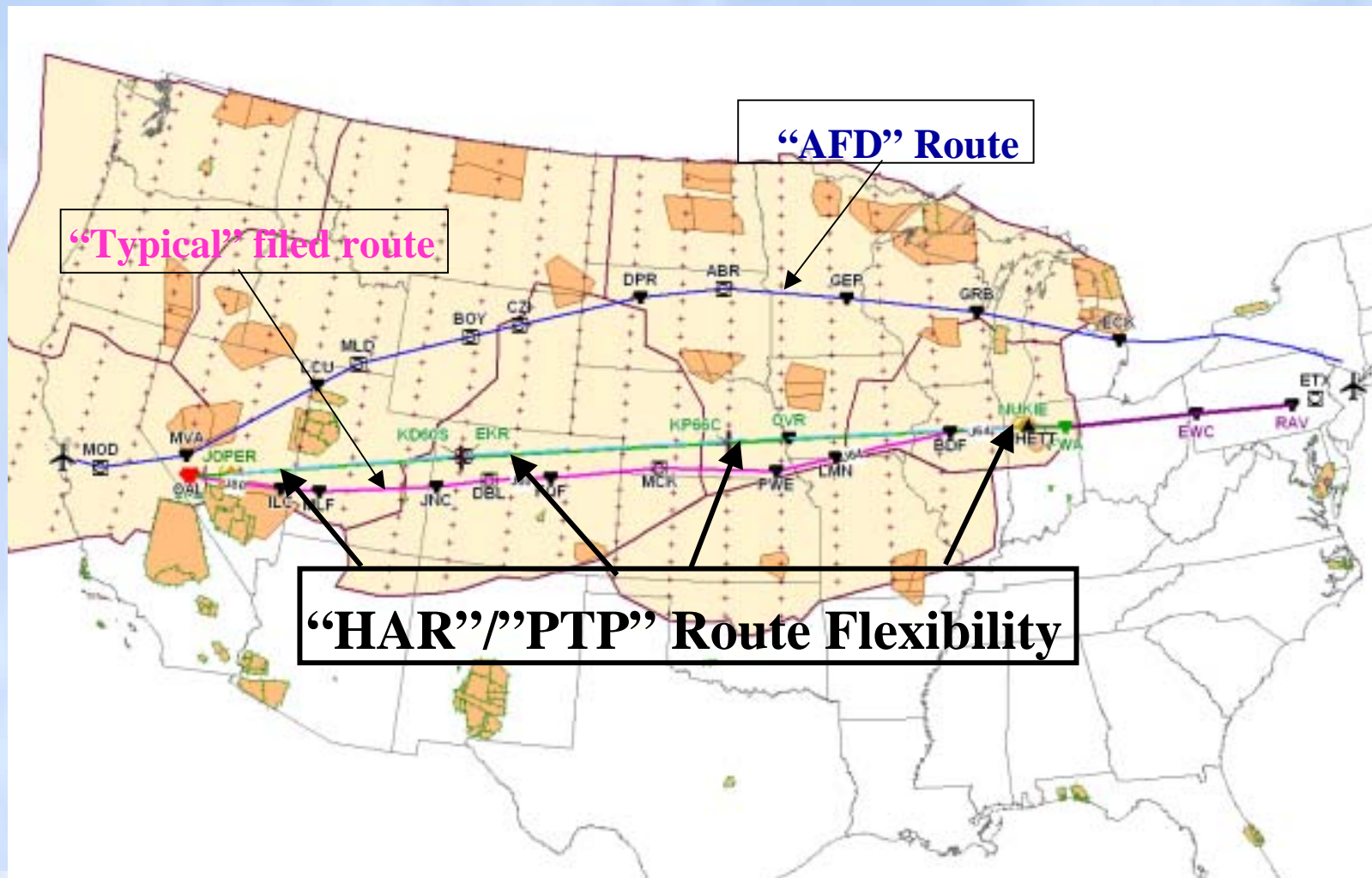




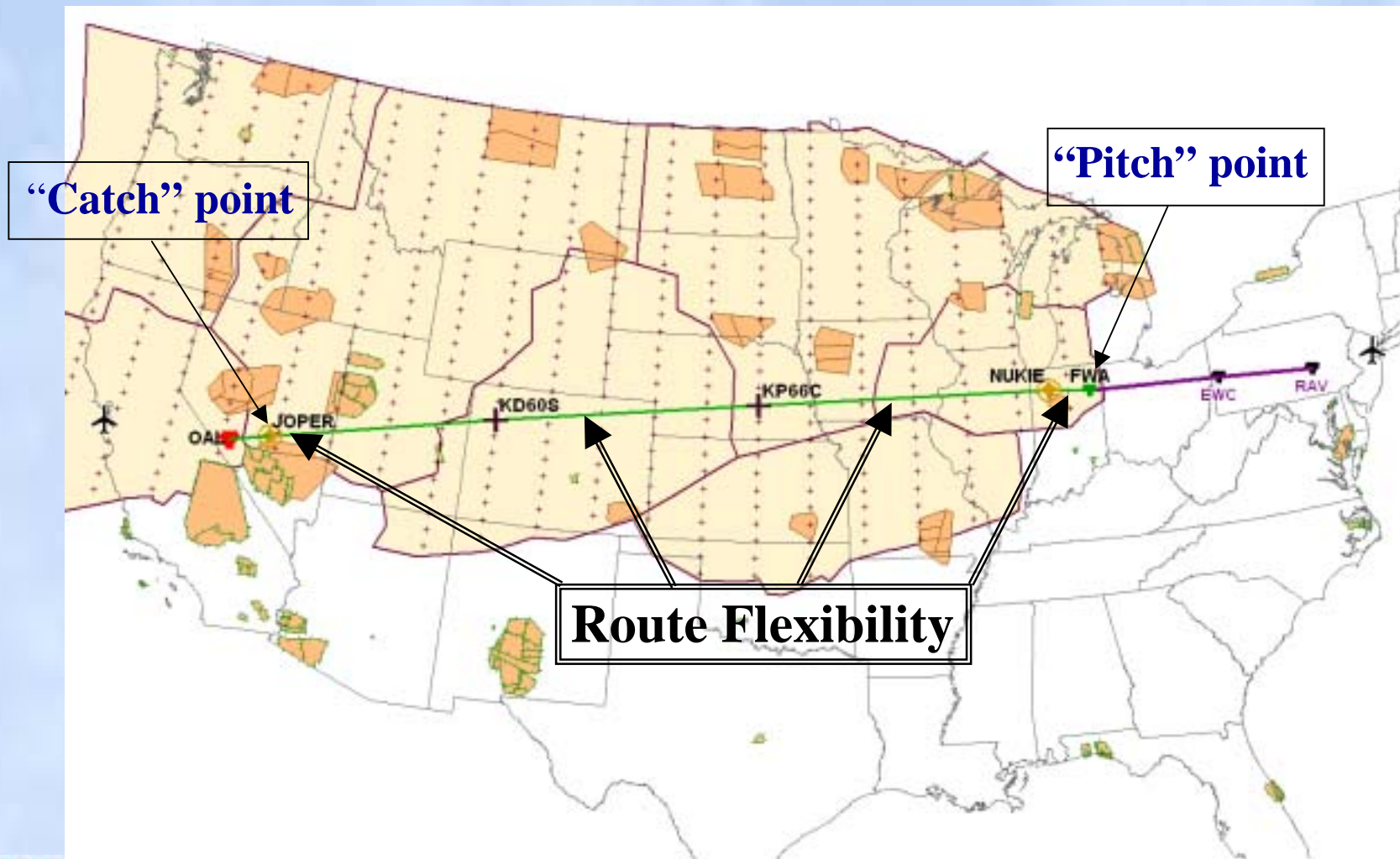
# NRS - CONUS Fully Populated Density



# Non-Restrictive Routing (NRR)

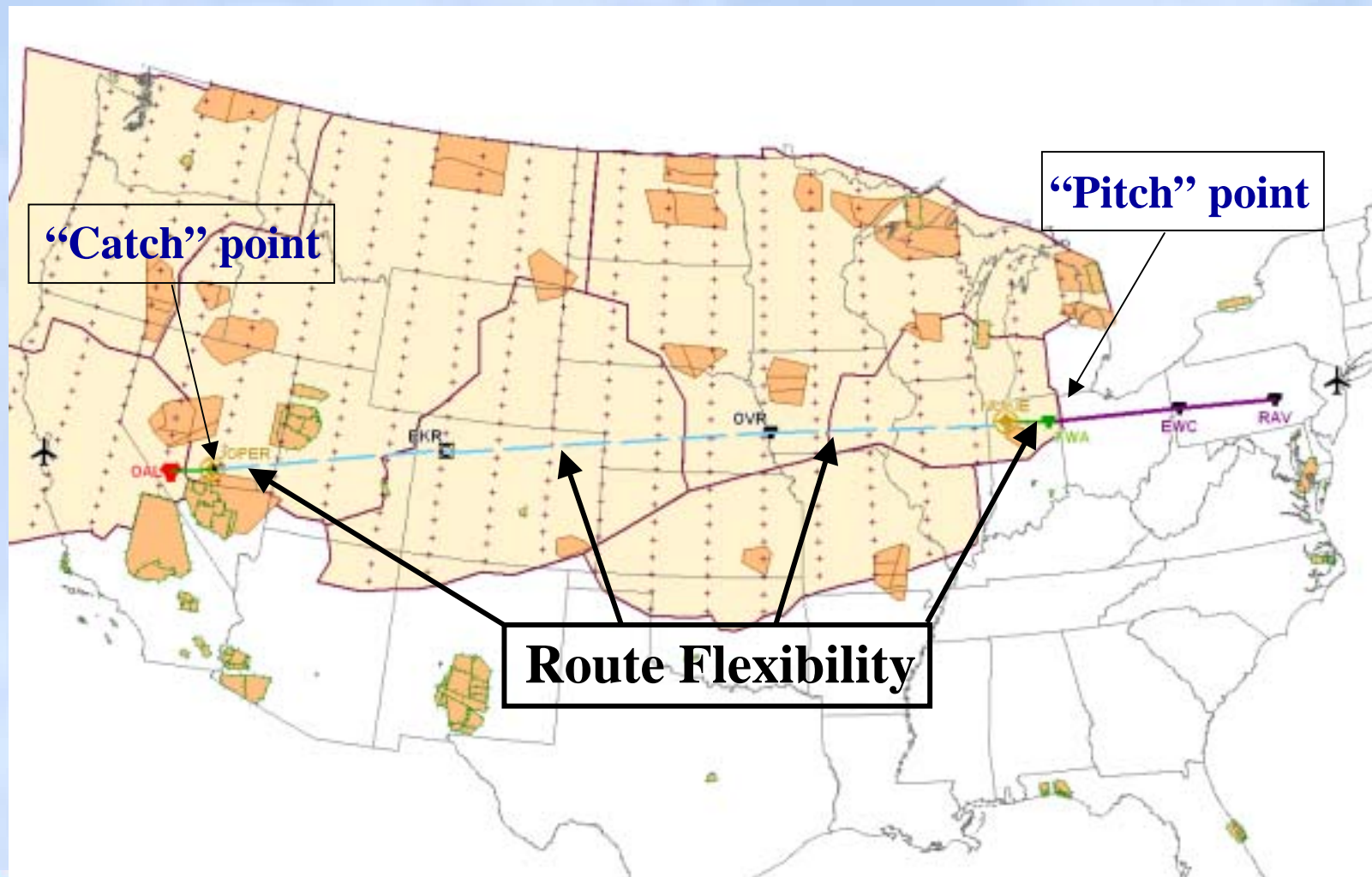


# Example NRR “HAR” Flight (Using NRS Waypoints)

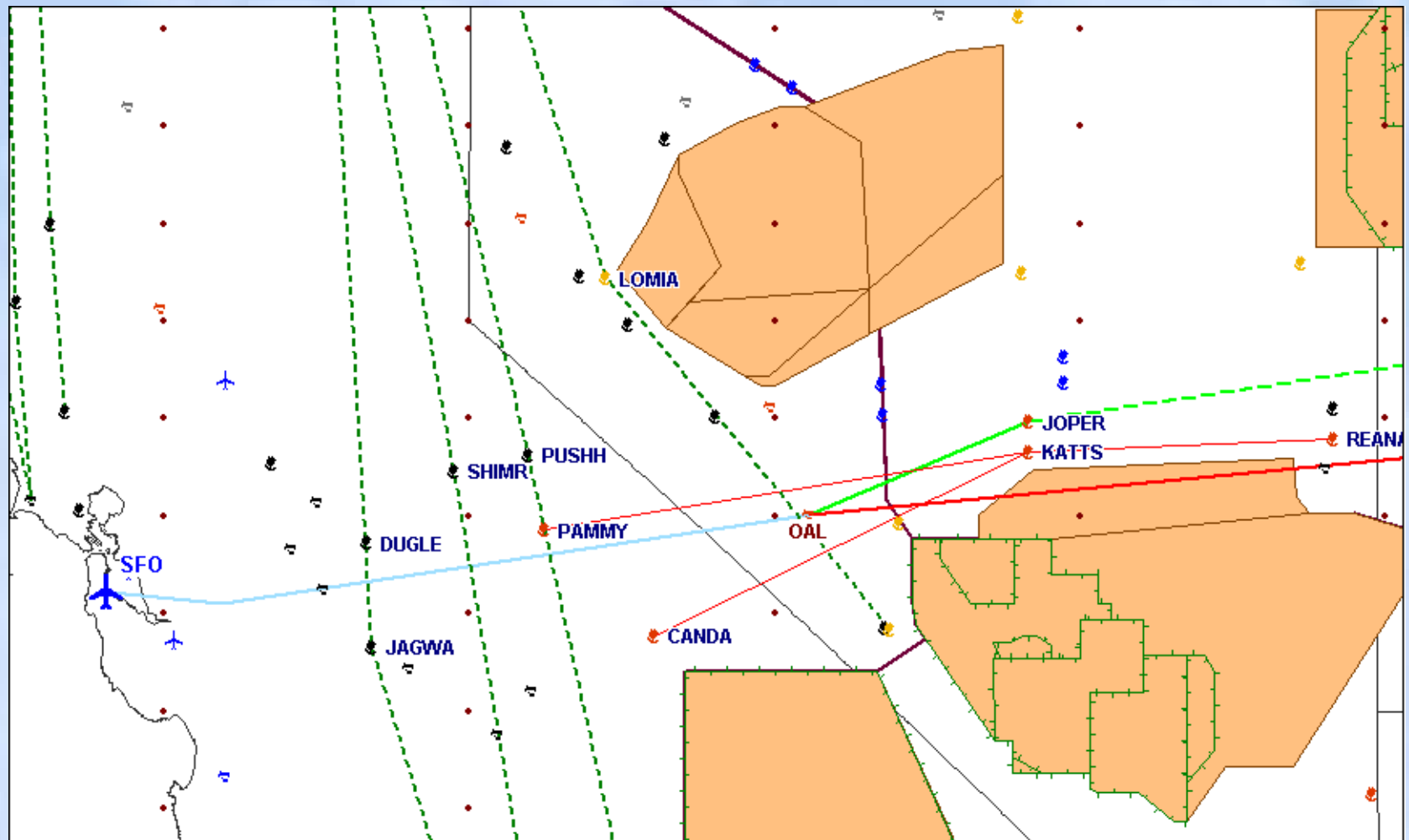




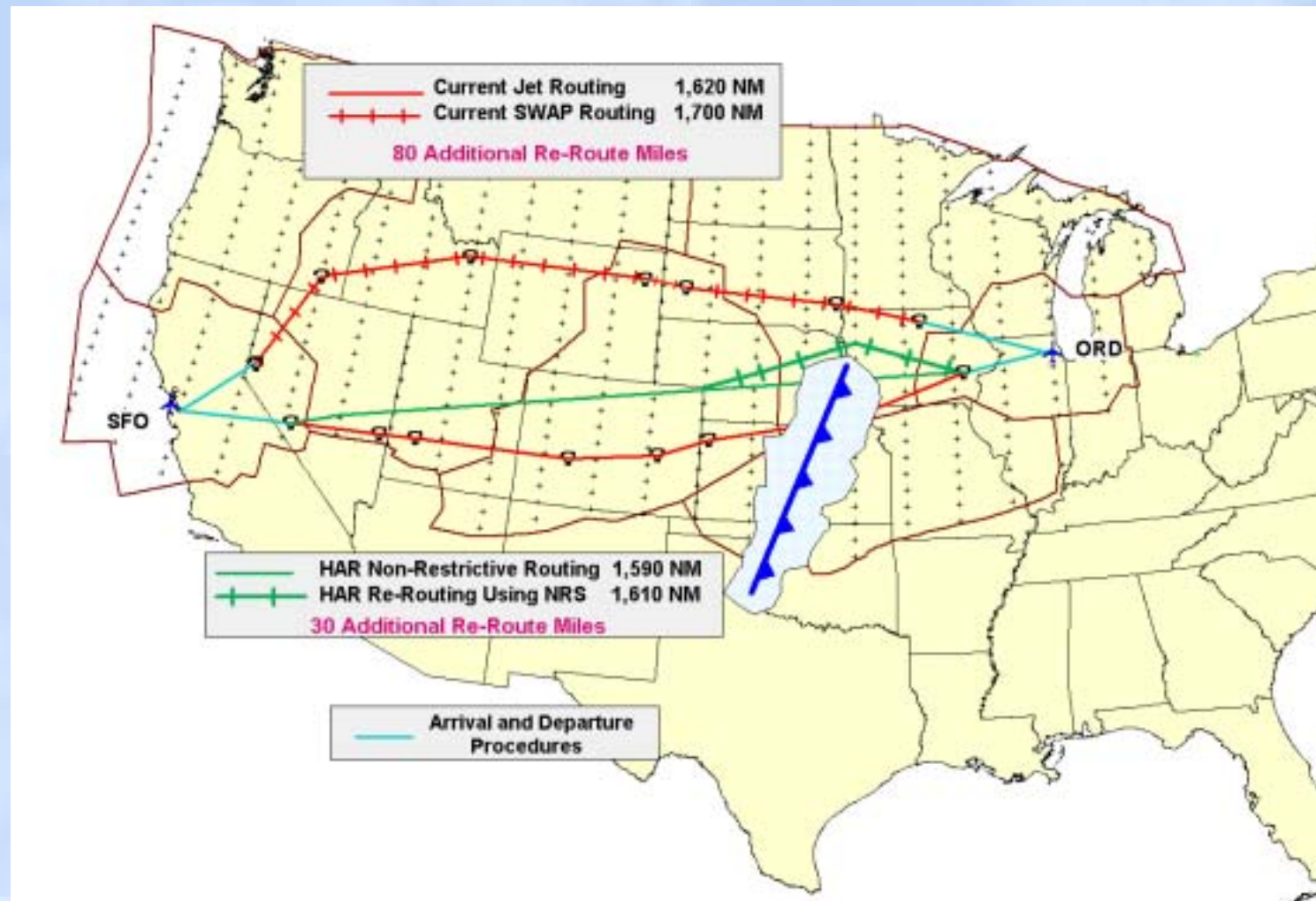
# Example NRR “PTP” Flight (Using Traditional Waypoints/Fixes)



# Routing Example: Confined Airspace



# HAR Weather Reroute with NRS





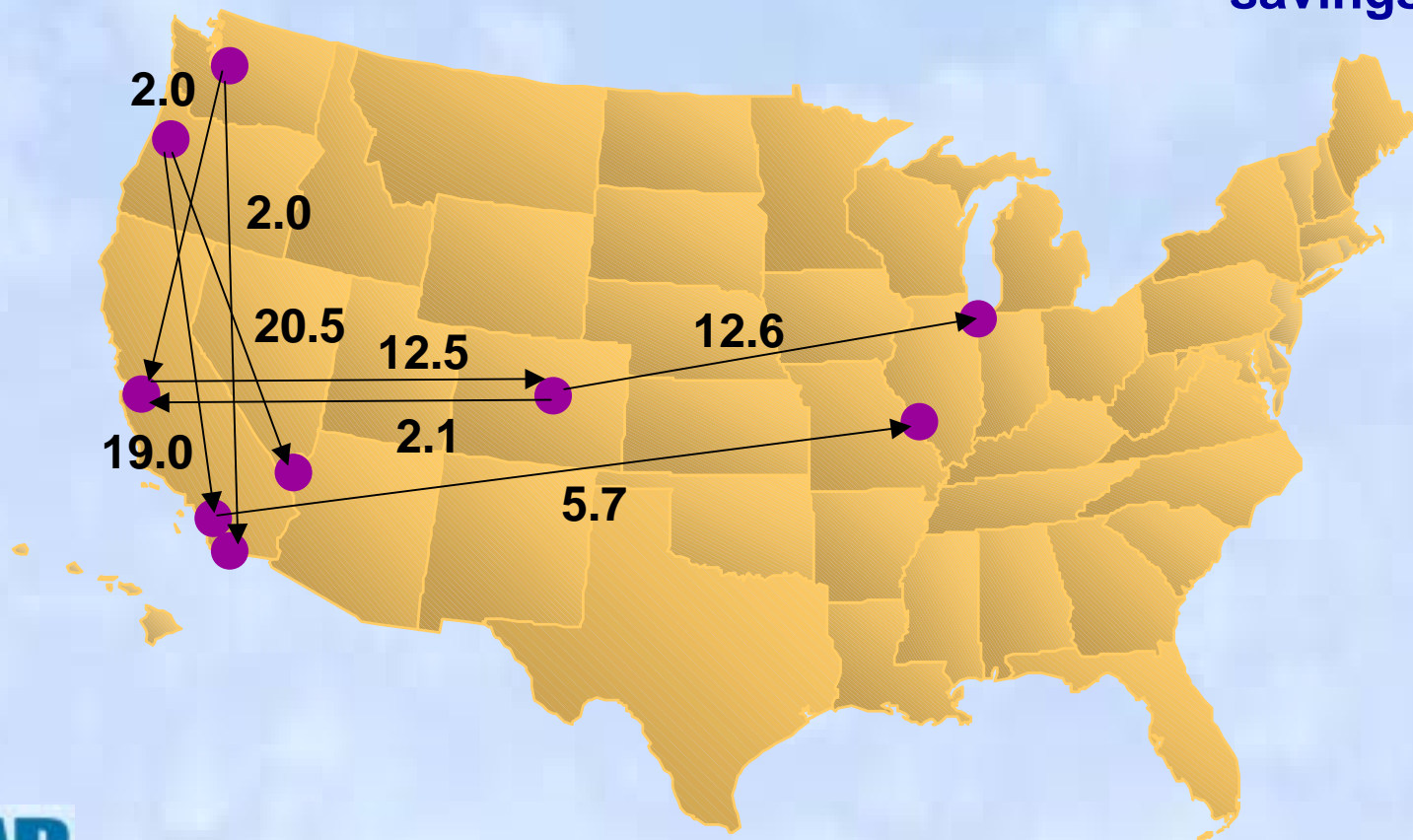
# Sample Benefits

(Initial airspace FL390 and above)

Looking at select city pairs, average distance saving of 8 miles per flight



estimated  
\$7M annual  
savings



# Analytic Foundation for Decisions

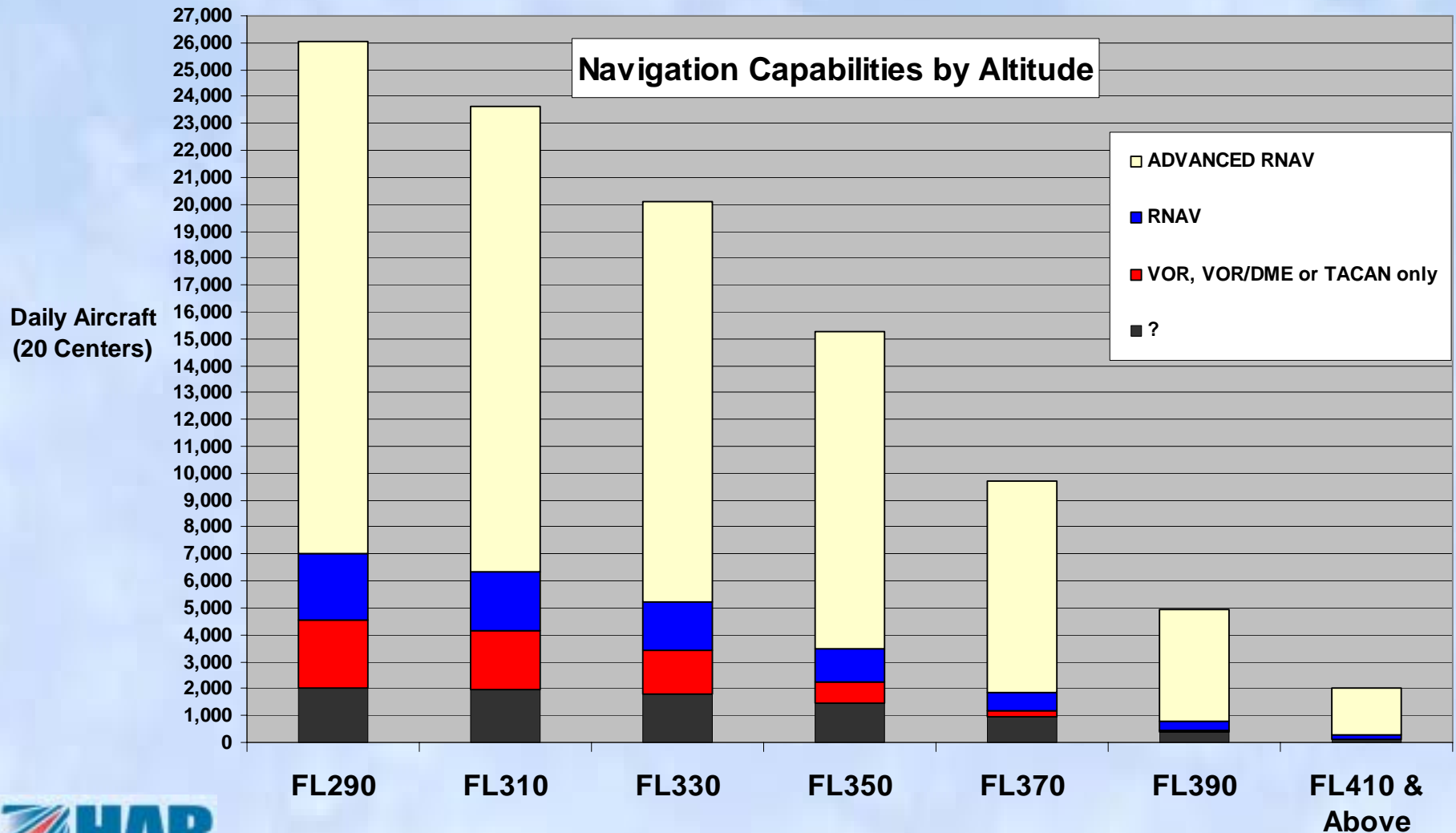
- Each phase supported by modeling
  - Proof of concept modeling
  - Designs modeled for benefits and workability
- After implementation of each phase, post-analysis will:
  - Validate concept and design
  - Measure benefit



Picture by Mary Yee

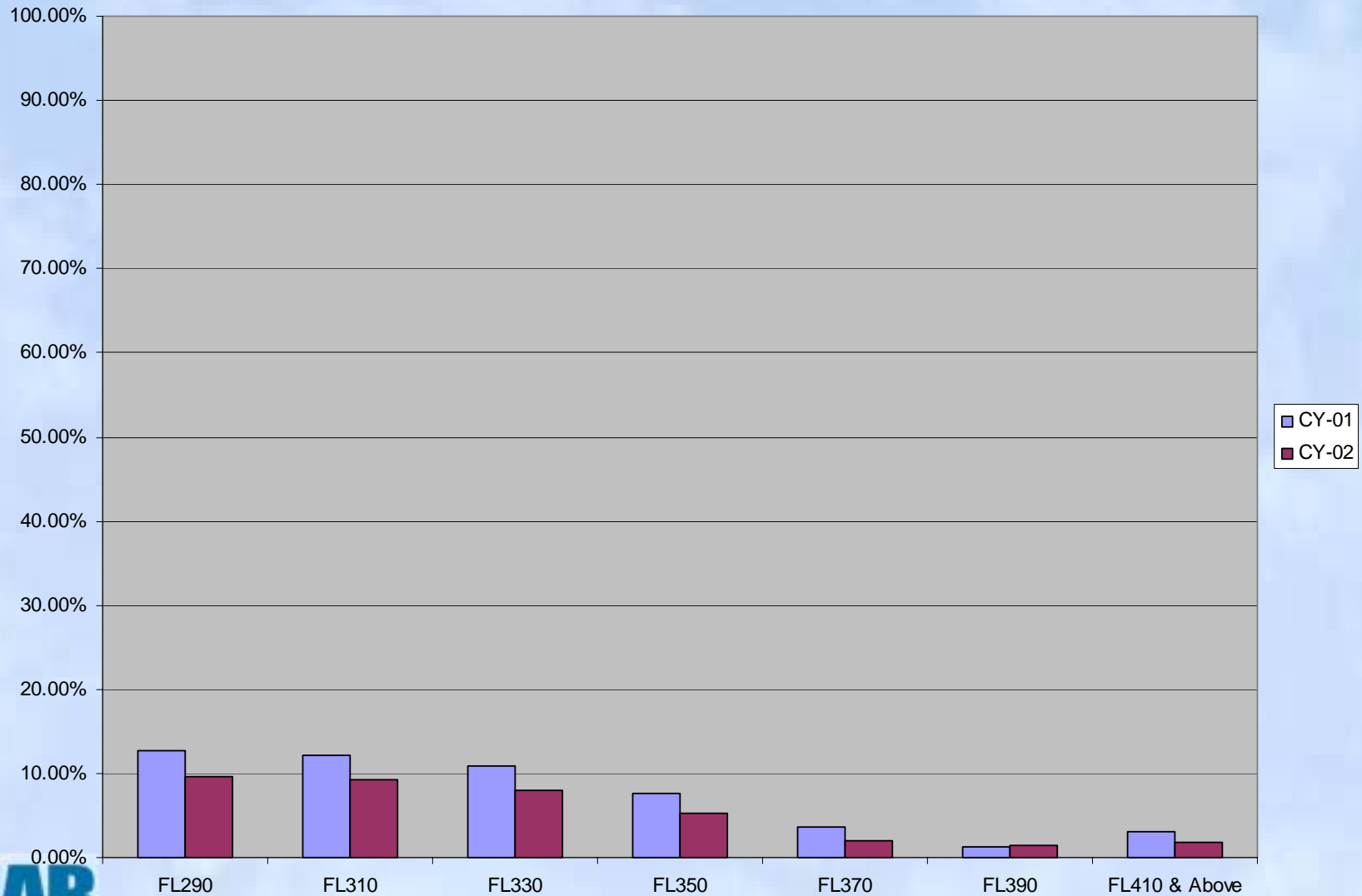
# User Environment

## Navigation Capabilities by Altitude\*



\*Updated data - 8/15/2002

# Non-RNAV CY-01 to CY-02



# Phase 1 Implementation “Roll Out”

*May 15, 2003*

Charting  
Waypoints

- Web access to SUA/ ATCAA schedule
- ATCAA/SUA Avoidance Trials

*July 10, 2003*

Chart “Q” Routes

- Initial 11 Q routes rules effective and routes charted – NOTAM NA

*Sept 4, 2003*

- “Improved” ATCAA/SUA Web site

*Sept. 23, 2003*

- Initiate use of Q Routes
- Initiate NRR (PTP)

*Feb. 19, 2004*

Chart NRS Waypoints

- Full HAR with NRR implemented
- Point-to-point for database limited A/C

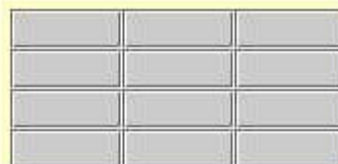
# Implementation

- **Advisory Circular – HAR Phase 1**
  - AC in internal coordination
- **SUA/ATCAA**
  - Air Traffic Control Assigned Airspace (ATCAA)/ Special Use Airspace (SUA) is being depicted via Internet WEB
    - [www.faa.mil/hialt](http://www.faa.mil/hialt)
    - September 4<sup>th</sup> - release of redesigned website:
      - Improve user interface consistency with similar sites
      - Add waypoints associated with each ATCAA/SUA
      - Provide ability to filter data by altitude
  - FAA Notices 7450.1, and 7210.547 issued to support near real time ATCAA database and schedule
  - Waypoints established near SUA/ATCAA airspace to aid in avoidance of active areas

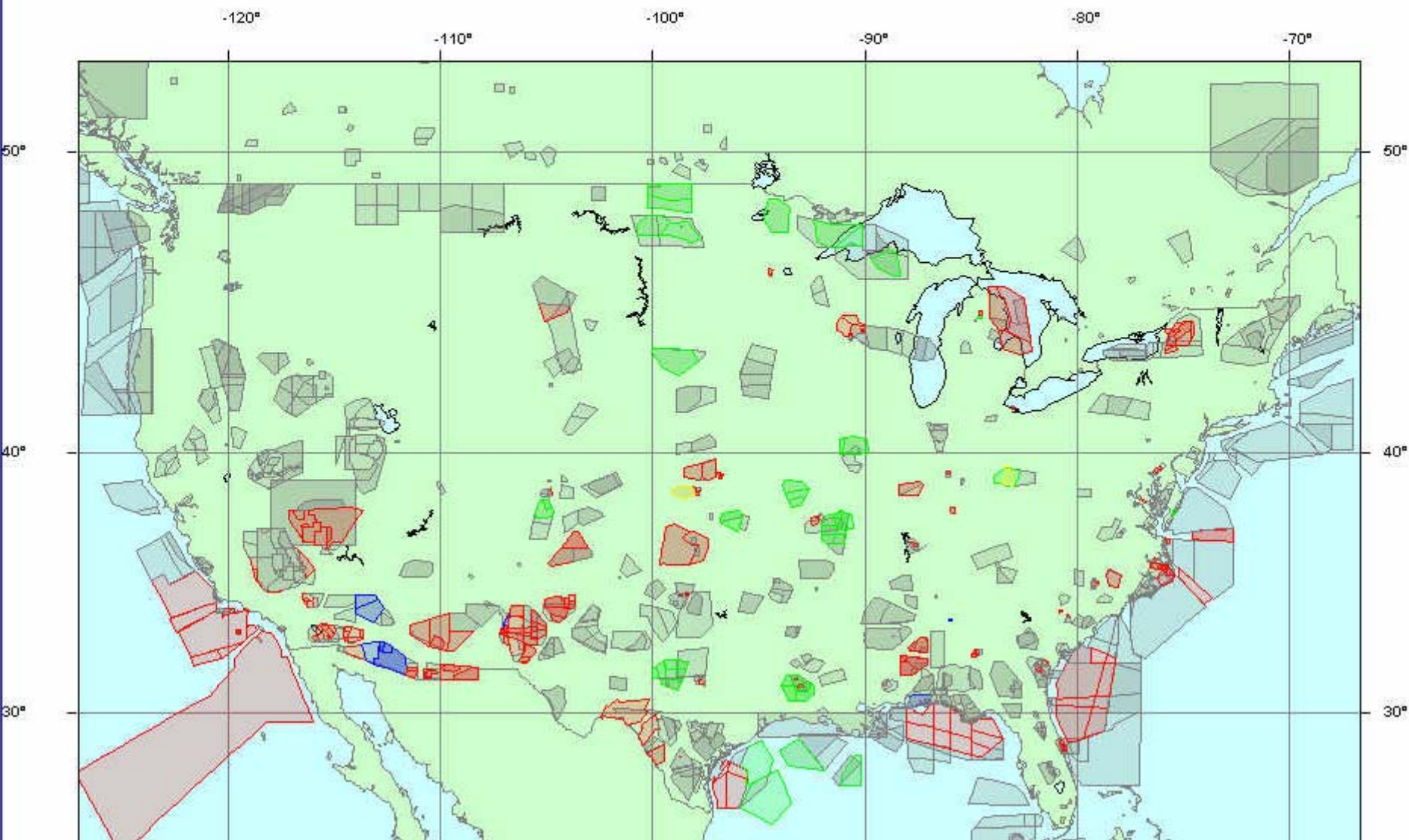




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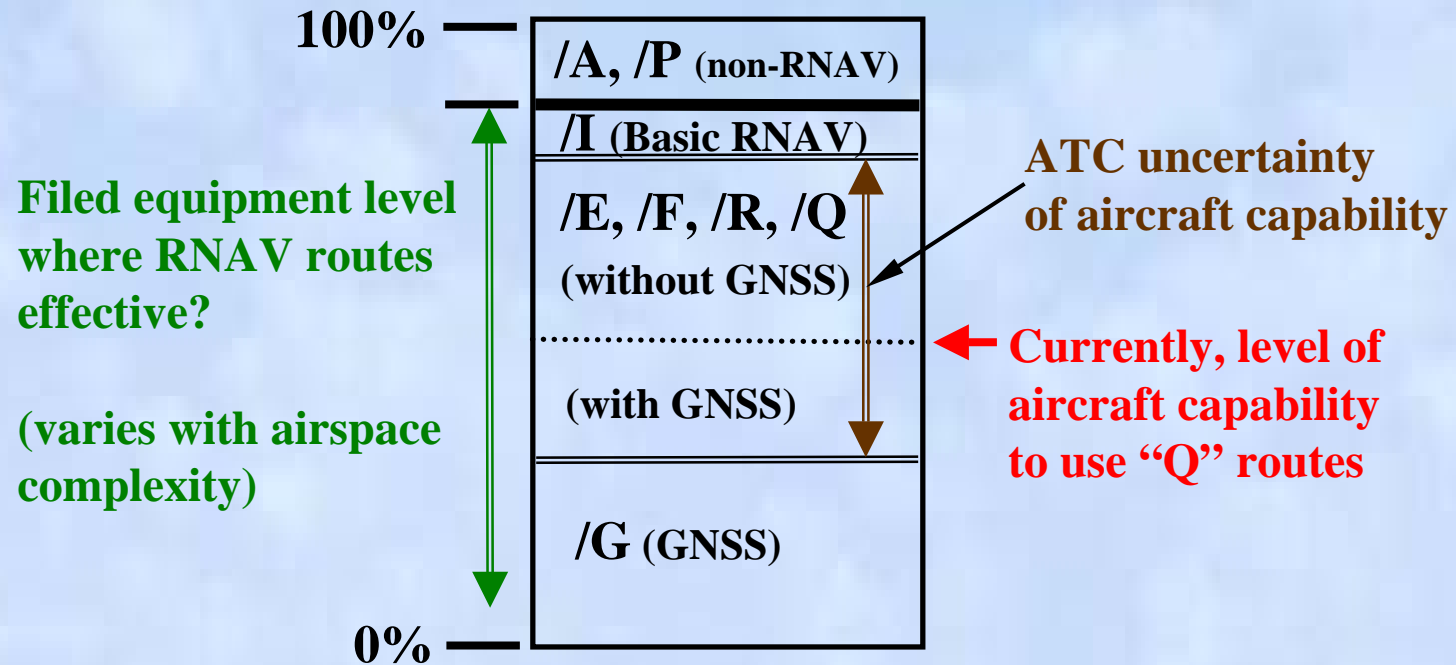


# Implementation (con't)

- Q routes - charted 7/10/03 with “GNSS Required”
- Q routes - NOTAM routes N/A to provide time to:
  - Ensure operational personnel are briefed and trained on current capabilities
  - Assess impact of RNAV and “GNSS required” decisions
  - Determine how each route will be operationally used
    - Controllers need to know which aircraft can be assigned a Q route
      - Proposing suffix changes to reflect Q route capability
- Begin flight planning of 11 Q routes at FL390 and above on September 23, 2003
  - NOTAM being revised

# Implementation (con't)

## Aircraft Filing Suffix



# Implementation (con't)

## Q Route Clearance by Equipment Suffix

Filed Suffix	Flight Plan	Tactical - Assign
A	N/A	N/A
I	Q Routes or specific waypoints	Q Routes/waypoints*
E	Q Routes or specific waypoints	Q Routes/waypoints*
F	Q Routes or specific waypoints	Q Routes/waypoints*
R	Q Routes or specific waypoints	Q Routes/waypoints*
Q	Q Routes or specific waypoints	Q Routes/waypoints*
G	Q Routes	Q Routes
* If Q routes were filed, ATC may assign another Q route; otherwise assign waypoints.		

# Implementation Status (con't)

- **Navigation Reference System (NRS)**
  - **Human Factors study**
    - **Part 1 – ATC assessment conducted during June with pilot observers**
    - **Part 2 – Pilot assessment planned for fall**
- **The new airspace structure charted for both users (pilots) and service providers (controllers)**
  - **NACO and Jeppsen have issued charts**
  - **Traditional waypoints and Q routes on existing charts**
  - **Format for depicting NRS waypoints established**
- **NASR database being modified with “fix usage”**

# Waypoint Estimates - HAR

High Altitude Redesign Waypoints - New (approximate)					
Phase	Timeframe	Centers	Pitch, Catch, SUA / ATCAA, Define Route	NRS	Cummulative Total
1 - Initial	CY-03	ZSE, ZDV, ZLC, ZOA, ZKC, ZMP, ZAU*	140	486	626
1 - Expansion A	CY-04	ZLA, ZAB, ZFW, ZHU, ZME, ZMA*, ZJX*	350	281	1,300
1 - Expansion B	CY-05	ZTL, ZDC, ZNY, ZBW, ZOB, ZID, ZAU**, ZMA**, ZJX**	500	191	2,000
Full U. S. w/NRS Resolution Max.	TBD	All 20 Domestic	1,000	6,500	7,500

Notes:

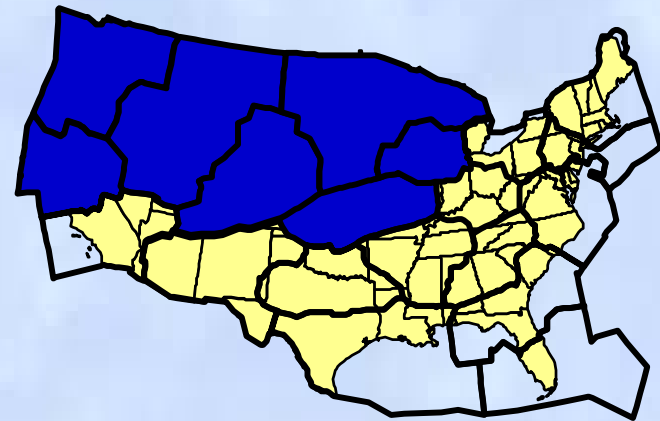
\* Partial

\*\* Remainder



# Summary

- In 2003/04, the initial deployment of High Altitude Redesign will provide benefits through:
  - RNAV/Parallel RNAV routes
  - RNAV waypoint navigation around SUA/ATCAA
  - Flexibility in routing: Non-Restrictive Routing (NRR)
  - Navigation Reference System (NRS) for point-to-point navigation
- Initial affected airspace:
  - ZAU, ZMP, ZLC, ZSE, ZOA, ZDV, ZKC
  - NRR FL390 & above,



# Discussion